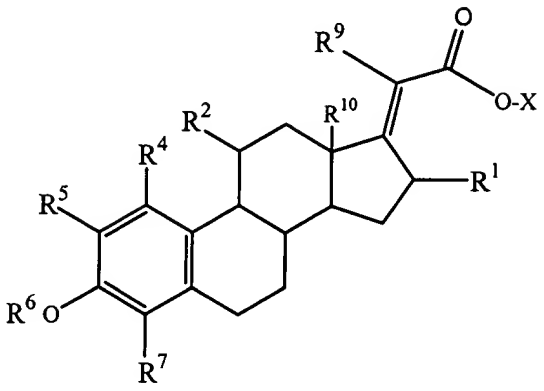
WE CLAIM:

1. A compound having the structural formula (I)

(I)



wherein:

X is lower hydrocarbyl;

R^1 is $CR^{11}R^{12}$, wherein R^{11} and R^{12} are hydrogen or lower alkyl;

R^2 is selected from the group consisting of hydrogen, hydroxyl, alkyl, $-OR^{13}$, and $-SR^{13}$ wherein R^{13} is alkyl;

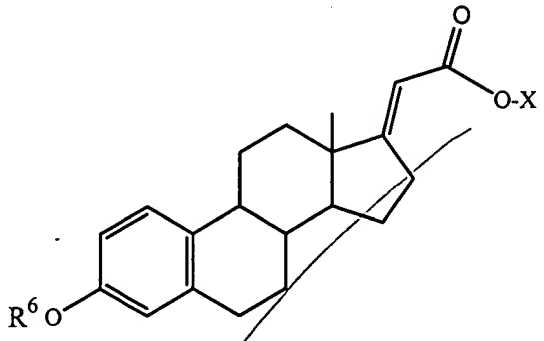
R^4, R^5, R^6, and R^7 are independently selected from the group consisting of hydrogen and lower alkyl;

R^9 is hydrogen or hydrocarbyl; and

R^{10} is methyl or ethyl.

2. The compound of claim 1, having the structural formula (II)

(II)



wherein:

X is lower alkyl; and

R^6 is selected from the group consisting of hydrogen and lower alkyl.

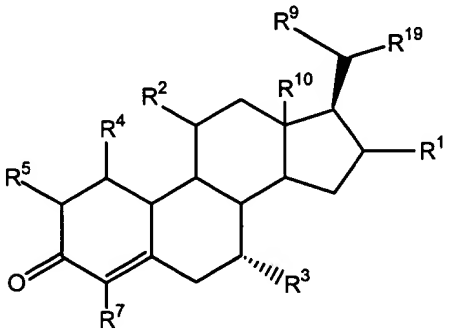
3. The compound of claim 2, wherein R^6 is hydrogen.

4. The compound of claim 2, wherein R^6 is lower alkyl.

5. The compound of claim 4, wherein R^6 is methyl.

6. A compound having the structural formula (III)

(III)



wherein:

R^1 is $CR^{11}R^{12}$, wherein R^{11} and R^{12} are hydrogen or lower alkyl;

R^2 is selected from the group consisting of hydrogen, hydroxyl, alkyl, $-OR^{13}$, and $-SR^{13}$

wherein R^{13} is alkyl;

R^3 is selected from the group consisting of hydrogen and hydrocarbyl;

R^4, R^5, and R^7 are independently hydrogen or lower alkyl;

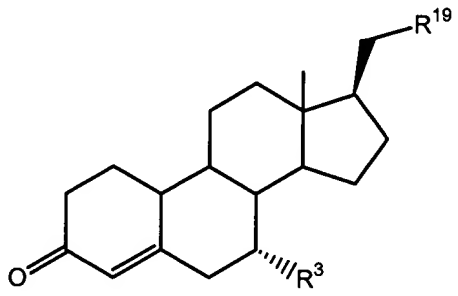
R^9 is hydrogen or hydrocarbyl;

R^{10} is methyl or ethyl; and

R^{19} is hydroxyl, hydroxymethyl, protected hydroxyl, protected hydroxymethyl, activated hydroxyl, or activated hydroxylmethyl.

7. The compoundof claim 6, having the structural formula (IV)

(IV)



wherein:

R^3 is hydrogen or lower alkyl; and

R^{19} is hydroxyl, hydroxymethyl, -O-acetyl, or -O-tetrahydropyranyl.

8. The compound of claim 7, wherein R^3 is hydrogen or methyl, and R^{19} is hydroxymethyl.

9. The compound of claim 8, wherein R^3 is hydrogen.

10. The compound of claim 8, wherein R^3 is methyl.

11. The compound of claim 7, wherein R^3 is hydrogen or methyl, and R^{19} is hydroxyl.

12. The compound of claim 11, wherein R^3 is hydrogen.

13. The compound of claim 11, wherein R^3 is methyl.

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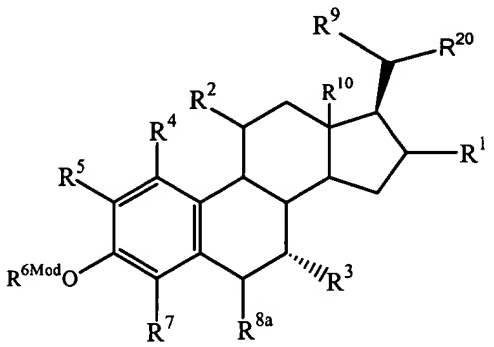
14. A compound having the structural formula (V)

(V)



wherein:

R^1 is hydrogen or $CR^{11}R^{12}$, wherein R^{11} and R^{12} are hydrogen or lower alkyl;

R^2 is selected from the group consisting of hydrogen, hydroxyl, alkyl, $-OR^{13}$, and $-SR^{13}$ wherein R^{13} is alkyl;

R^3 is selected from the group consisting of hydrogen and hydrocarbyl;

R^4, R^5, and R^7 are independently selected from the group consisting of hydrogen and lower alkyl;

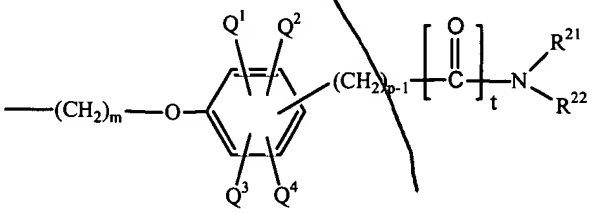
R^{6Mod} is selected from the group consisting of hydrogen, alkyl, acyl, -C(O)-aryl, -C(O)-alkyl, hydroxyl-protecting groups, and hydroxyl-activating groups;

R^{8a} is selected from the group consisting of hydrogen, hydroxyl, oxo, and $-OR^{18}$ wherein R^{18} is lower alkyl or lower acyl;

R^9 is hydrogen or alkyl;

R^{10} is methyl or ethyl; and

R^{20} is hydroxyl, hydroxymethyl, protected hydroxyl, protected hydroxymethyl, activated hydroxyl, activated hydroxymethyl, or

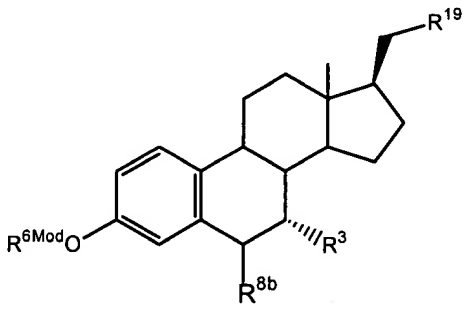


in which m is zero or 1, p is an integer in the range of 1 to 7 inclusive, t is zero or 1, with the proviso that when R^{8a} is oxo, t is 1, and when R^{8a} is hydrogen, t is zero, and R^{21} and R^{22} are lower alkyl or are linked together to form a five- or six-membered heterocycloalkyl ring; and

Q^1, Q^2, Q^3, and Q^4 are independently selected from the group consisting of hydrogen, hydroxyl, carboxyl, alkoxy, alkyl, halogen, amino, and alkyl-substituted amino.

15. The compound of claim 14, having the structural formula (VI)

(VI)



wherein:

R^3 is hydrogen or lower alkyl;

R^{6Mod} is hydrogen or a hydroxyl-protecting group;

R^{8b} is selected from the group consisting of hydrogen, hydroxyl, and oxo; and

R^{19} is hydroxyl, hydroxymethyl, protected hydroxyl, protected hydroxymethyl, activated hydroxyl, or activated hydroxymethyl.

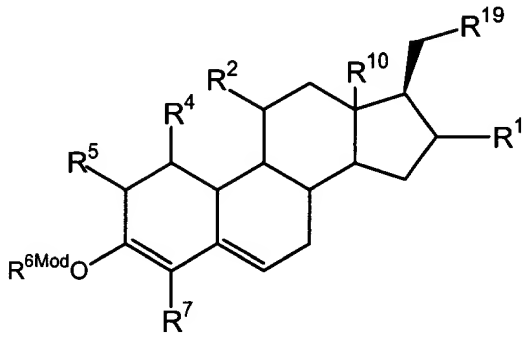
16. The compound of claim 15, wherein R^3 is hydrogen or methyl, R^{6Mod} is hydrogen or lower alkyl, R^{8b} is oxo, and R^{19} is hydroxyl, hydroxymethyl, -O-acetyl, or -O-tetrahydropyranyl.

17. The compound of claim 16, wherein R^3 is methyl.

18. The compound of claim 17, wherein R^{6Mod} is isopropyl.

19. A compound having the structural formula (XXVII)

(XXVII)



wherein:

R^1 is hydrogen or $CR^{11}R^{12}$, wherein R^{11} and R^{12} are hydrogen or lower alkyl;

R^2 is selected from the group consisting of hydrogen, hydroxyl, alkyl, $-OR^{13}$, and $-SR^{13}$ wherein R^{13} is alkyl;

R^4, R^5, and R^7 are independently selected from the group consisting of hydrogen and lower alkyl;

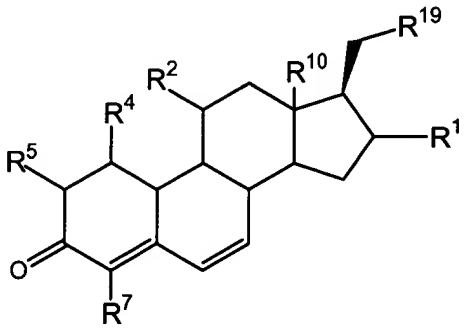
R^{6Mod} is selected from the group consisting of hydrogen, alkyl, acyl, -C(O)-aryl, -C(O)-alkyl, hydroxyl-protecting groups, and hydroxyl-activating groups;

R^{10} is methyl or ethyl; and

R^{19} is hydroxyl, hydroxymethyl, protected hydroxyl, protected hydroxymethyl, activated hydroxyl, or activated hydroxymethyl.

20. A compound having the structural formula (XXVIII)

(XXVIII)



wherein:

R^1 is hydrogen or $CR^{11}R^{12}$, wherein R^{11} and R^{12} are hydrogen or lower alkyl;

R^2 is selected from the group consisting of hydrogen, hydroxyl, alkyl, $-OR^{13}$, and $-SR^{13}$ wherein R^{13} is alkyl;

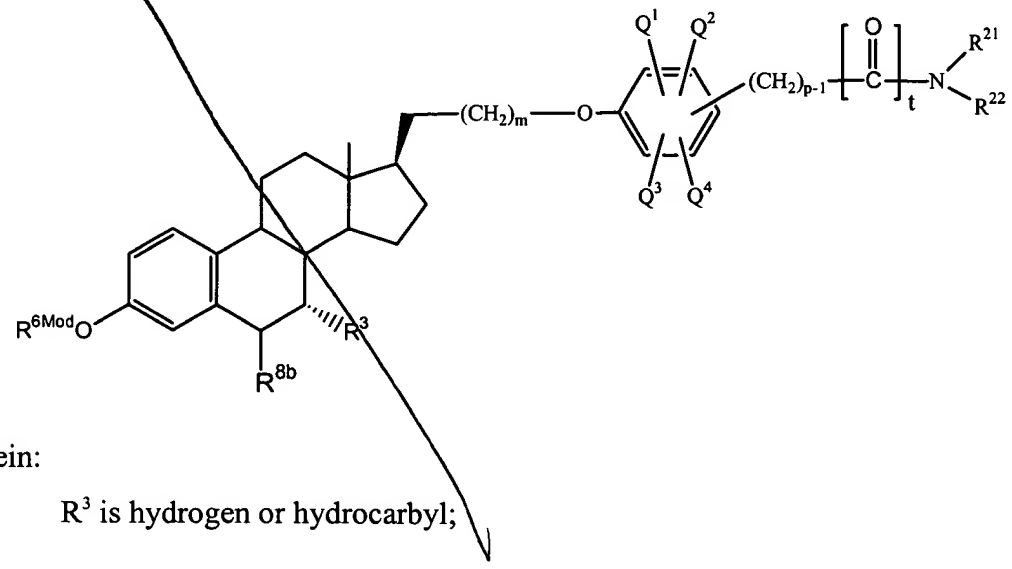
R^4, R^5, and R^7 are independently selected from the group consisting of hydrogen and lower alkyl;

R^{10} is methyl or ethyl; and

R^{19} is hydroxyl, hydroxymethyl, protected hydroxyl, protected hydroxymethyl, activated hydroxyl, or activated hydroxymethyl.

21. A compound having the structural formula (VII)

(VII)



wherein:

R^3 is hydrogen or hydrocarbyl;

A3 Cont

R^{6Mod} is selected from the group consisting of hydrogen, alkyl, acyl, -C(O)-aryl, and -C(O)-alkyl, hydroxyl-protecting groups, and hydroxyl-activating groups;

R^{8b} is selected from the group consisting of hydrogen, hydroxyl, and oxo;

m is zero or 1;

p is an integer in the range of 1 to 7 inclusive;

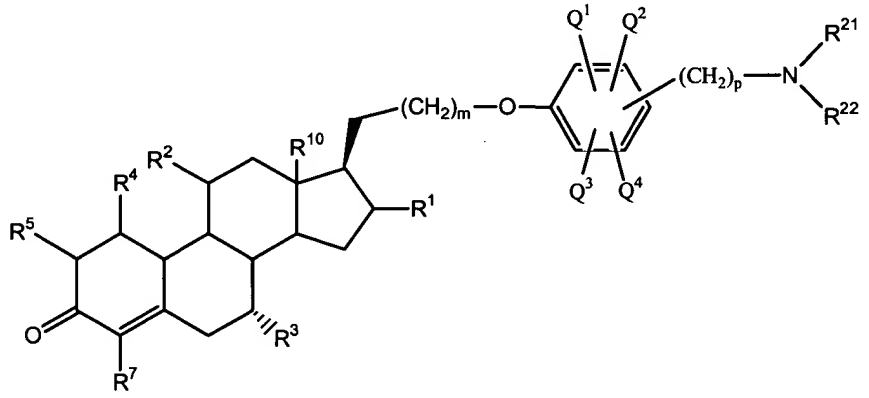
t is zero or 1, with the proviso that when R^{8a} is oxo, t is 1, and when R^{8a} is hydrogen, t is zero, and;

R^{21} and R^{22} are lower alkyl or are linked together to form a five- or six-membered heterocycloalkyl ring; and

Q^1, Q^2, Q^3, and Q^4 are independently selected from the group consisting of hydrogen, hydroxyl, carboxyl, alkoxy, alkyl, halogen, amino, and alkyl-substituted amino.

22. A compound having the structural formula (XVI)

(XVI)



wherein:

R^1 is $CR^{11}R^{12}$, wherein R^{11} and R^{12} are hydrogen or lower alkyl;

R^2 is selected from the group consisting of hydrogen, hydroxyl, alkyl, $-OR^{13}$, and $-SR^{13}$ wherein R^{13} is alkyl;

R^3 is hydrogen or hydrocarbyl;

R^4 and R^5 are independently selected from the group consisting of hydrogen and lower alkyl;

R^7 is hydrogen or lower alkyl;

R^{10} is methyl or ethyl;

m is zero or 1;

p is an integer in the range of 1 to 7 inclusive;

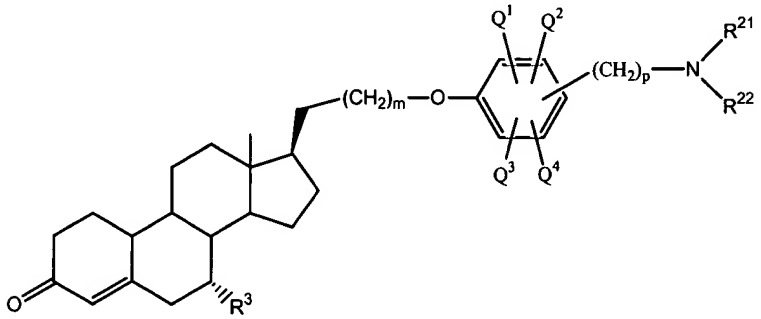
R^{21} and R^{22} are lower alkyl or are linked together to form a five- or six-membered heterocycloalkyl ring; and

Q^1, Q^2, Q^3, and Q^4 are independently selected from the group consisting of hydrogen, hydroxyl, carboxyl, alkoxy, alkyl, halogen, amino, and alkyl-substituted amino,

or a pharmacologically acceptable acid addition salt thereof.

23. The compound of claim 22, having the structural formula (XVII)

(XVII)



wherein:

m is zero or 1;

p is an integer in the range of 1 to 7 inclusive;

R^3 is hydrogen or lower alkyl;

R^{21} and R^{22} are lower alkyl or are linked together to form a five- or six-membered heterocycloalkyl ring; and

Q^1, Q^2, Q^3, and Q^4 are independently selected from the group consisting of hydrogen, hydroxyl, carboxyl, alkoxy, alkyl, halogen, amino, and alkyl-substituted amino,

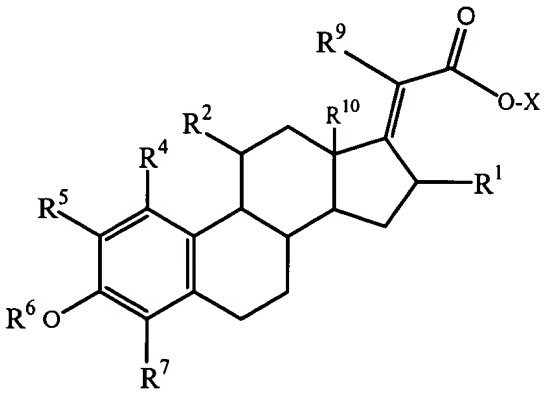
or a pharmacologically acceptable acid addition salt thereof.

24. The compound of claim 21, wherein R^3 is lower alkyl.

25. The compound of claim 22, wherein R^3 is methyl.

26. A method for synthesizing 21-hydroxy-19-norpregna-4-en-one and substituted analogs thereof, comprising treating a starting material having the structural formula (I)

(I)



with an alkali metal in the presence of ammonia or an alkylamine, wherein, in formula (I),

X is lower hydrocarbyl;

R^1 is $CR^{11}R^{12}$, wherein R^{11} and R^{12} are hydrogen or lower alkyl;

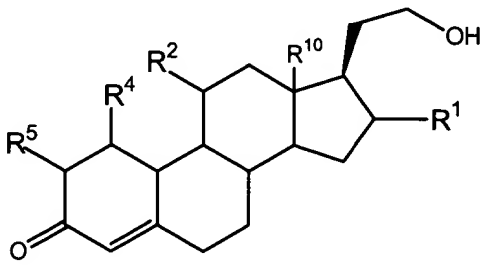
R^2 is selected from the group consisting of hydrogen, hydroxyl, alkyl, $-OR^{13}$, and $-SR^{13}$ wherein R^{13} is alkyl;

R^4, R^5, R^6, and R^7 are independently selected from the group consisting of hydrogen and lower alkyl;

R^9 is hydrogen or hydrocarbyl; and

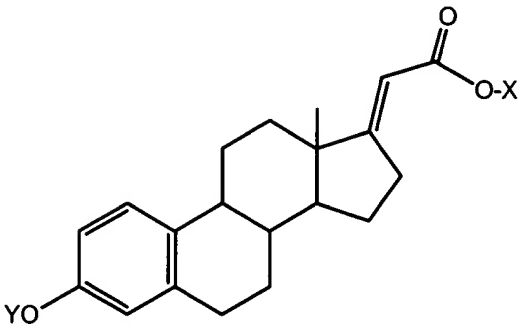
R^{10} is methyl or ethyl, resulting in a reaction product having the structural formula (VIII)

(VIII)



27. A method for synthesizing 21-hydroxy-19-norpregna-4-en-3-one, comprising treating (IX)

(IX)

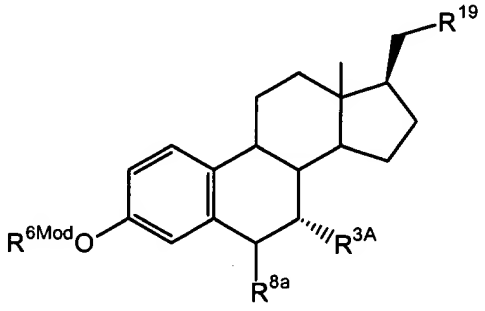


wherein X and Y are independently lower alkyl, with an alkali metal in the presence of ammonia or an alkylamine.

28. A method for synthesizing a 7-alkyl-6-keto-1,3,5(10) estratriene, comprising contacting a 19-norpregna-4-en-3-one with gaseous oxygen in the presence of base, followed by reaction of the intermediate so provided with an alkyl halide.

29. A method for synthesizing a 7-alkyl-6-keto-1,3,5(10) estratriene having the structural formula (VIa)

(VIa)



wherein:

R^{3A} is lower alkyl;

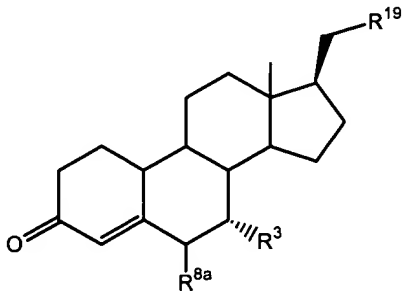
R^{6Mod} is hydrogen or a hydroxyl-protecting group;

R^{8a} is hydrogen or oxo; and

R^{19} is hydroxyl, hydroxymethyl, protected hydroxyl, or protected hydroxymethyl, the method comprising the steps of

(a) contacting the 19-norpregna-4-en-3-one (X)

(X)



with oxygen in the presence of a base;

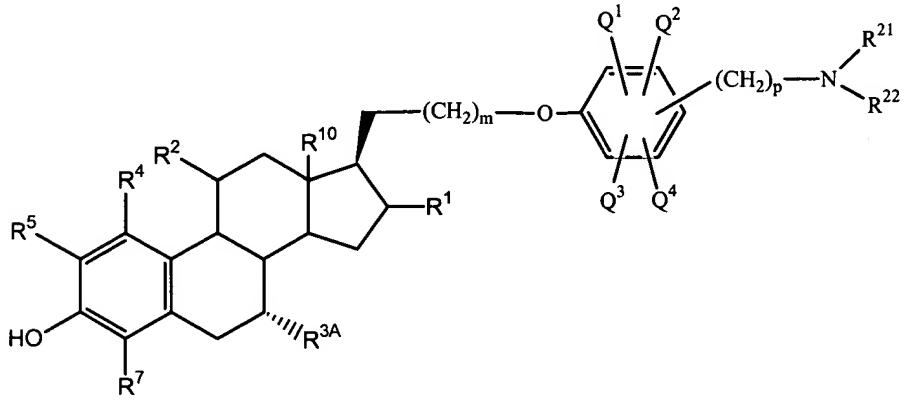
(b) protecting the 3-hydroxyl group thus formed with a protecting group, and

(c) treating the 3-hydroxyl-protected intermediate with an alkyl halide.

30. A method for synthesizing an anti-estrogenic steroid having the structural formula

(XI)

(XI)



wherein:

R^1 is $CR^{11}R^{12}$, wherein R^{11} and R^{12} are hydrogen or lower alkyl, and when r1 is absent, R^1 is hydrogen or alkyl;

R^2 is selected from the group consisting of hydrogen, hydroxyl, alkyl, and $-OR^{13}$ wherein R^{13} is alkyl;

R^{3A} is lower alkyl;

R^4, R^5, R^6, and R^7 are independently selected from the group consisting of hydrogen and lower alkyl; and

R^{10} is methyl or ethyl;

m is zero or 1;

p is an integer in the range of 1 to 7 inclusive;

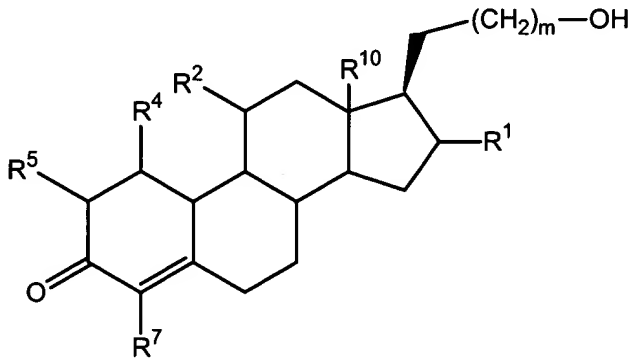
R^{21} and R^{22} are lower alkyl or are linked together to form a five- or six-membered heterocycloalkyl ring; and

Q^1, Q^2, Q^3, and Q^4 are independently selected from the group consisting of hydrogen, hydroxyl, carboxyl, alkoxy, alkyl, halogen, amino, and alkyl-substituted amino,

said method comprising:

(a) providing a starting material having the structural formula (XII)

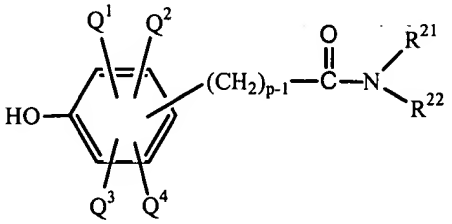
(XII)



;

(b) converting the -OH group to an -O-LG moiety wherein LG is a leaving group displaceable by nucleophilic attack, and displacing LG by reaction with a hydroxyl-containing compound having the structural formula (XIII)

(XIII)



;

(c) oxidizing the A ring and providing a 6-keto moiety by exposure to gaseous oxygen in the presence of base;

(d) protecting the 3-hydroxyl group with a protecting group;

(e) contacting the product of step (d) with an alkyl halide, to provide a 7α-alkyl substituent; and

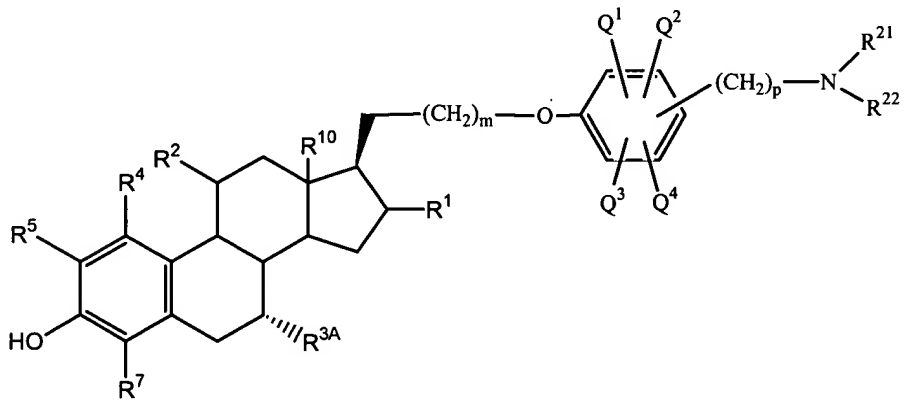
(f) reducing the compound so provided to remove all keto moieties,

with the proviso that steps (c) and (d) may occur prior to or simultaneously with step (b).

31. The method of claim 30, further including (g) treating the product of step (f) with an acid to produce an acid addition salt.

32. A method for synthesizing an anti-estrogenic steroid having the structural formula (XI)

(XI)



wherein:

R^1 is $CR^{11}R^{12}$, wherein R^{11} and R^{12} are hydrogen or lower alkyl;

R^2 is selected from the group consisting of hydrogen, hydroxyl, alkyl, and $-OR^{13}$ wherein R^{13} is alkyl;

R^{3A} is lower alkyl;

R^4, R^5, R^6 and R^7 are independently selected from the group consisting of hydrogen and lower alkyl; and

R^{10} is methyl or ethyl.

m is zero or 1;

p is an integer in the range of 1 to 7 inclusive;

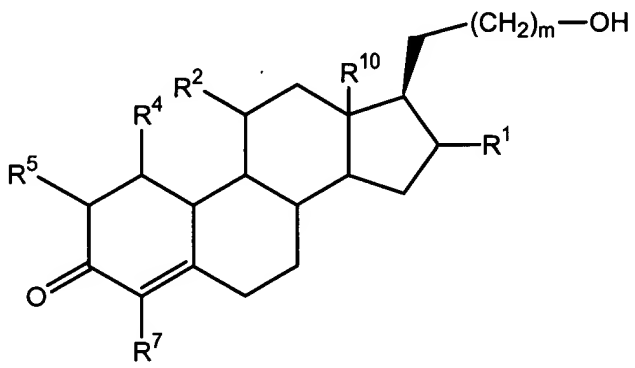
R^{21} and R^{22} are lower alkyl or are linked together to form a five- or six-membered heterocycloalkyl ring; and

Q^1, Q^2, Q^3, and Q^4 are independently selected from the group consisting of hydrogen, hydroxyl, carboxyl, alkoxy, alkyl, halogen, amino, and alkyl-substituted amino,

said method comprising:

(a) providing a starting material having the structural formula (XII)

(XII)



;

(b) protecting the -OH group and the oxy group with protecting groups, thereby converting the compound into a diene;

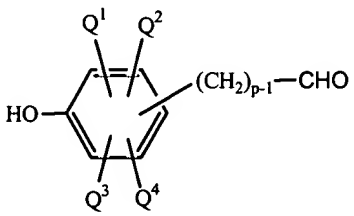
(c) deprotecting the oxy group to form a dienone;

(d) contacting the product of step (b) with an alkyl lithium in the presence of a lithium halide, to provide a 7α-alkyl substituent;

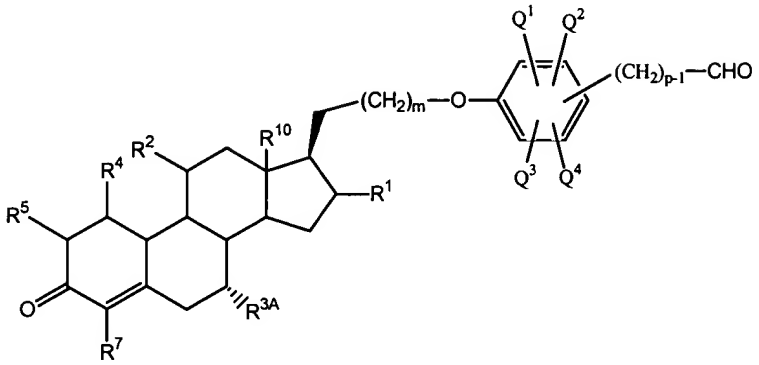
(e) deprotecting the -OH group;

(f) effecting reaction between the -OH group and an aldehyde having the structural formula (XIV)

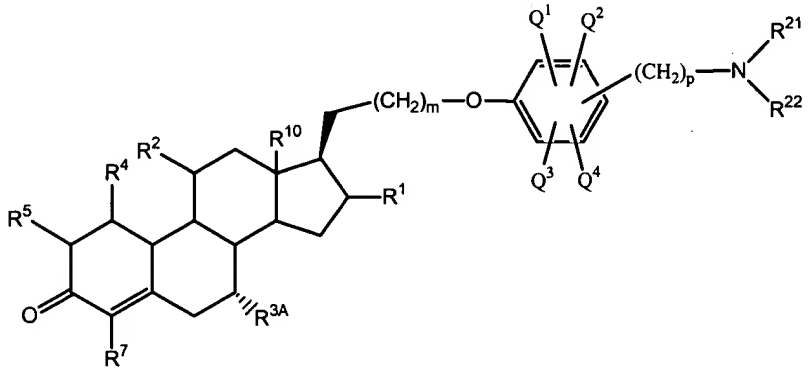
(XIV)



to result in an intermediate having the structural formula (XV)

(XV)  ;

(g) treating (XV) with an alkylamine having the structure $HNR^{21}R^{22}$ under reaction conditions effective to produce the amine (XVI)

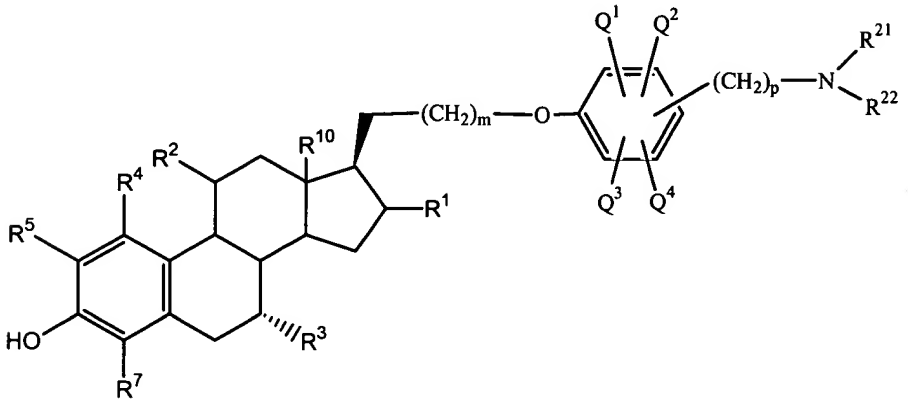
(XVI)  ; and

(h) oxidizing and thereby aromatizing the A ring by reaction with a suitable oxidizing agent or agents.

33. The method of claim 32, further including (i) treating the product of step (h) with an acid to produce an acid addition salt.

34. A method for synthesizing an anti-estrogenic steroid having the structural formula

(XI)

(XI) 

wherein:

R^1 is $CR^{11}R^{12}$, wherein R^{11} and R^{12} are hydrogen or lower alkyl, and when r1 is absent, R^1 is hydrogen or alkyl;

R^2 is selected from the group consisting of hydrogen, hydroxyl, alkyl, and $-OR^{13}$ wherein R^{13} is alkyl;

R^{3A} is lower alkyl;

R^4, R^5, R^6, and R^7 are independently selected from the group consisting of hydrogen and lower alkyl; and

R^{10} is methyl or ethyl;

m is zero or 1;

p is an integer in the range of 1 to 7 inclusive;

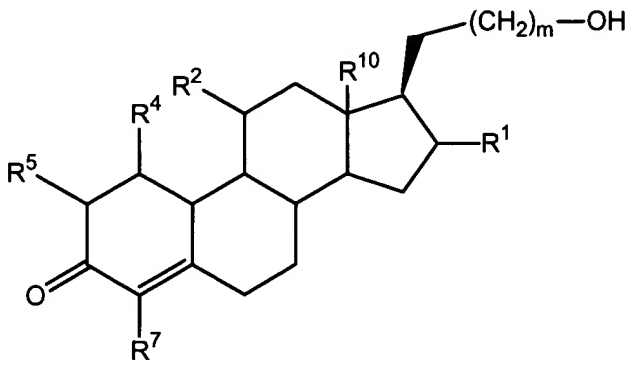
R^{21} and R^{22} are lower alkyl or are linked together to form a five- or six-membered heterocycloalkyl ring; and

Q^1, Q^2, Q^3, and Q^4 are independently selected from the group consisting of hydrogen, hydroxyl, carboxyl, alkoxy, alkyl, halogen, amino, and alkyl-substituted amino,

said method comprising:

(a) providing a starting material having the structural formula (XII)

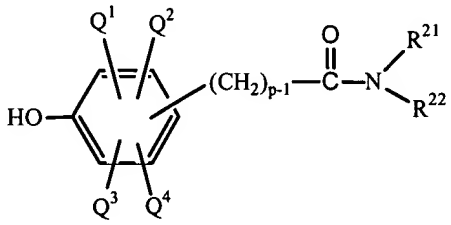
(XII)



;

(b) converting the -OH group to an -O-LG moiety wherein LG is a leaving group displaceable by nucleophilic attack, and displacing LG by reaction with a hydroxyl-containing compound having the structural formula (XIII)

(XIII)



;

(c) oxidizing the A ring to form a diene and protecting resulting the 3-hydroxyl group with a protecting group;

(d) converting the protected 3-hydroxyl group into an oxo group, thereby forming a dienone;

(e) contacting the product of step (d) with an alkyl lithium in the presence of lithium halide, to provide a 7α-alkyl substituent; and

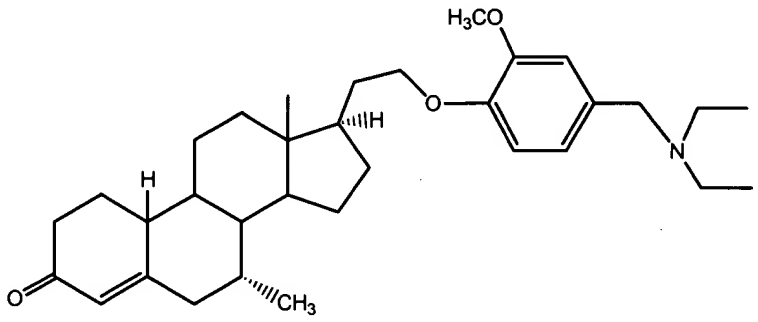
(f) reducing the compound so provided to remove all keto moieties.

35. The method of claim 34, further including (g) treating the product of step (f) with an acid to produce an acid addition salt.

36. A pharmaceutical composition for administration of a therapeutic agent, comprising a therapeutically effective amount of the compound of claim 20, in combination with a pharmaceutically acceptable carrier.

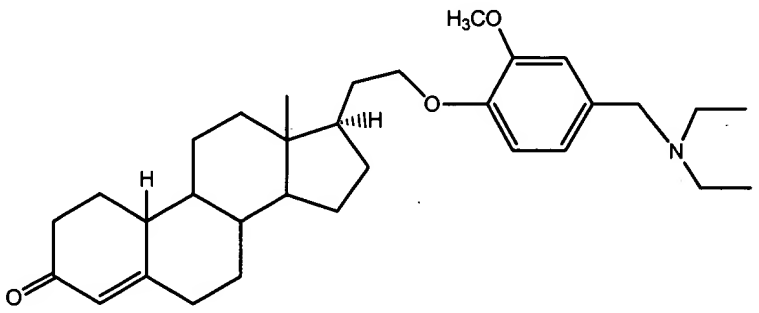
37. A pharmaceutical composition for administration of a therapeutic agent, comprising a therapeutically effective amount of the compound of claim 21, in combination with a pharmaceutically acceptable carrier.

38. A pharmaceutical composition for administration of a therapeutic agent, comprising a therapeutically effective amount of a compound having the structural formula



or a pharmaceutically acceptable acid addition salt thereof, in combination with a pharmaceutically acceptable carrier.

39. A pharmaceutical composition for administration of a therapeutic agent, comprising a therapeutically effective amount of a compound having the structural formula



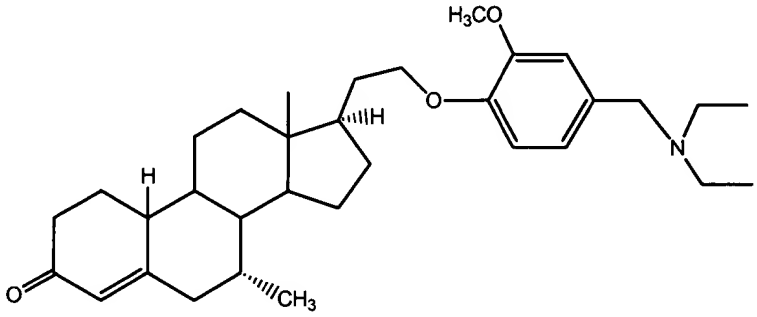
or a pharmaceutically acceptable acid addition salt thereof, in combination with a

pharmaceutically acceptable carrier.

40. A method for treating a human patient suffering from a prostate disorder, comprising administering to the patient, within the context of an effective dosage regimen, a therapeutically effective amount of the compound of claim 20.

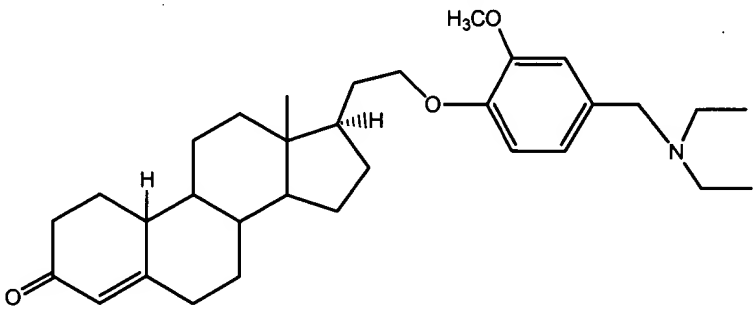
41. A method for treating a human patient suffering from a prostate disorder, comprising administering to the patient, within the context of an effective dosage regimen, a therapeutically effective amount of the compound of claim 21.

42. A method for treating a human patient suffering from a prostate disorder, comprising administering to the patient, within the context of an effective dosage regimen, a therapeutically effective amount of a compound having the structural formula



or a pharmaceutically acceptable acid addition salt thereof.

43. A method for treating a human patient suffering from a prostate disorder, comprising administering to the patient, within the context of an effective dosage regimen, a therapeutically effective amount of a compound having the structural formula



or a pharmaceutically acceptable acid addition salt thereof.

~~44~~. A method for stereoselectively adding an alkyl moiety to the 7α position of a 6 keto steroid comprising providing a C^{19} or C^{20} tetrehydropyranyl protected hydroxyl moiety on the steroid and reacting the protected steroid with an alkylhalide in the presence of base.